REMARKS

The application is believed to be in condition for allowance.

Status of Application

Claims 1-19 were previously pending, with claims 1-6, 9, 10, 17 and 19 under examination as applicants elected Group I responsive to a restriction requirement (see Amendment of December 28, 2001).

This amendment amends pending claim 1, cancels claims 7-8, 11-16 and 18, and introduces new claims 20-28.

Claims 20-22 are each independent claims. Claim 20 is based on pending claim 1 and original claim 2. Claims 21-22 are also based on pending claim 1. Claims 23-24 are based on claim 2. Claims 25-28 are based on the disclosure of specification pages 11-12 and Figures 2-3.

In the response filed on September 23, 2002, applicants provided a Reference Table (in two sheets) which compared the present invention to a conventional technique as shown, for example, in FUJISAKI et al. In reviewing that response, it was noted that the arrangements for two-phase AC were incorrect. Attached herewith is an amended Reference Table (again in two sheets), the corrections being clearly indicated.

Pending Formal Rejection

Claims 1-6, 9-10, and 19 stand rejected under §112, second paragraph as being indefinite. In particular, the recitation "non-moving, vibrating magnetic field" was said to be vague.

The Official Action suggested overcoming this rejection by amending claim 1 to include the recitations of claim 2. Applicants thank the Examiner for this suggestion and have added new independent claim 20, which claims combines pending claim 1 with claim 2.

Claim 1 has been amended to overcome this rejection by defining what is meant by a non-moving, vibrating magnetic field. The paragraph spanning specification pages 16-17 provide support for the new recitations of "wherein non-moving magnetic field is defined in that a wave representing an intensity distribution in a direction of a longitudinal width of the casting mold thereof does not move in a certain direction."

New claim 21 is based on pending claim 1 with a further recitation similar to that now added to claim 1. Claim 21 includes the recitation of "the non-moving magnetic field being a waveform representing an intensity distribution in a direction of a longitudinal width of the casting mold, a phase of the waveform remaining constant over time in that the waveform does not move in the direction of the longitudinal width of the casting mold."

Claim 22 is based on pending claim 1 with a further recitation of "the non-moving, vibrating magnetic field being a waveform alternating in opposite directions and, during the same time, representing an intensity distribution in a direction of a longitudinal width of the casting mold, a phase of the waveform remaining constant over time in that the waveform does not move in the direction of the longitudinal width of the casting mold." Attention is directed to specification page 4, lines 4-10, defining the phrase "non-moving, vibrating magnetic field" as connoting a magnetic flux alternating in opposite directions.

Dependent claims 25-28 more specifically detail the nature of the induced magnetic field. As per specification pages 11-12 and Figures 2-3, the present invention sets up non-moving, vibrating magnetic fields in at least two ways.

Claims 25-26 recite the non-moving, vibrating magnetic field being produced by magnetic forces developed between adjacent electromagnets arranged adjacent to each other on a same side of the mold producing vibrating flows only in the direction of the longitudinal width of the mold. See Figure 2.

Claims 27-28 recite the non-moving, vibrating magnetic field being produced by magnetic forces developed between opposing electromagnets arranged on opposite sides of the mold producing vibrating flows only in a direction transverse to the longitudinal width of the mold. See Figure 3.

In view of the above, reconsideration and withdrawal of this rejection are respectfully requested.

Pending Substantive Rejection

Claims 1-6, 9-10, 17 and 19 stand rejected under §103, as being obvious of FUJISAKI et al. 5,746,268.

Applicants respectfully disagree as FUJISAKI et al. do not disclose the recited non-moving, vibrating magnetic field. Accordingly, for this reason alone, at least as to all the claims other the claim 17, the obviousness rejection is not viable.

As an initial manner, applicants note that independent claims 1 and 20-22 recite "applying a non-moving, vibrating magnetic field..." whereas independent claim 17 recites a moving magnetic field. See claim 17 reciting "moving said AC magnetic field in a longitudinally symmetrical relation from opposite ends to a center of said mold along a longitudinal width thereof."

Accordingly, the following remarks will be divided into two sections; a first section dealing with claims 1 and 20-22 (and claims depending therefrom) and a second section dealing with claim 17.

Applicants enclose FUJISAKI et al.: "Fundamental Electromagnetic Characteristics of In-Mold Electromagnetic Stirring in Continuous Casting", a report from "International Symposium on Electromagnetic Processing of Materials," 1994, ISIJ (Iron and Steel Institute of Japan), pages 272-277.

1 As to Claims 1-6, 9-10, and 19-28

1.1 Definition

It is pointed out by the Official Action that the recitations, in terms of "non-moving, vibrating magnetic field", of "vibrating" and "non-moving", are contrary to each other. This is not the case. The wording of "non-moving" does not mean "a magnetic field which does not vary" but means, "there is no moving (shifting or traveling) of magnetic poles (and therefore, magnetic fields or waves) to a certain direction". That being the case, the expression, "the magnetic field vibrates" does not make any contradictory statement to "non-moving".

For the better comprehension of "non-moving, vibrating magnetic field", explanation in detail by comparing with "moving magnetic field" ("traveling flux" or "shifting field" in some documents) which are of conventional arts, will now be reviewed.

For explanation, the enclosed technical paper of FUJISAKI, et al., (hereinbelow represented as the FUJISAKI paper) is attached herewith. Meanwhile, to differentiate from FUJISAKI paper, the applied FUJISAKI et al. patent is hereinafter referred to as the FUJISAKI patent.

In the FUJISAKI paper in Item 2, lines 1 to 4, page 272 it is disclosed that in the electromagnetic stirring of molten steel inside a continuous casting mold, in a model case, the stirring coil and the molten steel are treated each as a linear induction motor. Further, in the succeeding lines 5 to 7, there

is disclosed an operation wherein, the stirring coil makes the **traveling flux** to the molten steel in the mold, therein the electromagnetic force is induced as the Lorentz's force in the molten steel. It is self-evident that the movement resultantly occurring thereby of the molten steel is naturally the flow of the molten steel. That is to say, the technique of "electromagnetic stirring" set forth the FUJISAKI paper shows that molten steel flow is generated by inducting a **moving magnetic field**, and not a kind of a method wherein molten steel is moved by randomly arraying electromagnets.

Concrete alignment of a coil is disclosed in the FUJISAKI paper, Item 4-4, page 277, by teaching the alignment of "u,-v,w,-u,v,-w". Herein, when the phase of u is regarded as a standard, the differences in phase are, v: -120° and w: -240°. In a supposed situation wherein alignment is made so that the N-pole points at the molten bath when positive electric charge is loaded to u, and if it is attempted to show the variation in the magnetic poles and their strength by time of each magnet at every phase degree of 30° each splitted in the range of the phase degrees of 0° to 360°, the state is demonstrated as tabulated in the following Table A1.

Table A1

Phase (degree) ↓	U	−v	w	−u	V	−w	U	−v	w	−u	v	−w
0	−	NN	NN	−	SS	SS	−	NN	NN	−	SS	SS
30	N	NN+	N	S	SS+	S	N	NN+	N	S	SS+	S
60	NN	NN	−	SS	SS	−	NN	NN	−	SS	SS	−
90	NN+	N	S	SS+	S	N	NN+	N	S	SS+	S	N
120	NN	−	SS	SS	−	NN	NN	−	SS	SS	−	NN
150	N	S	SS+	S	N	NN+	N	S	SS+	S	N	NN+
180	−	SS	SS	−	NN	NN	−	SS	SS	−	NN	NN
210	S	SS+	S	N	NN+	N	S	SS+	S	N	NN+	N
240	SS	SS	−	NN	NN	−	SS	SS	−	NN	NN	−
270	SS+	S	N	NN+	N	S	SS+	S	N	NN+	N	S
300	SS	−	NN	NN	−	SS	SS	−	NN	NN	−	SS
330	S	N	NN+	N	S	SS+	S	N	NN+	N	S	S+
360	−	NN	NN	−	SS	SS	−	NN	NN	−	SS	SS

NN+, SS+:Max, NN, SS:about 90% of Max, N, S:50% of Max

As is clear from Table A1 given above, the N-pole and the S-pole move toward the left-hand direction as time goes by. And thus, magnetic fields (or fluxes) created by the poles also move towards the left-hand direction. This is the characteristic of moving magnetic fields. Also, the molten steel flow caused thereby is a macro flow generated along the movement of magnetic poles (fields), ordinarily generated along the entire length of the rows of coils.

Note that although the FUJISAKI patent does not use wording, such as, "traveling flux" or "moving field", however, Figs. 3, 8, 9, 10, 20, 28, 52 and so forth show examples of moving fields wherein the alignment basically comprising u, −v, w, −u, v, −w is at least partially used and in many of the

drawings, like Fig. 3, for example, and so forth, the resultantly caused flow of the molten steel is represented by arrows. Furthermore, it is understood from the FUJISAKI patent that the rows of coils are also called linear motors (e.g., column 29, lines 19 to 24). Consequently, it is understood that the "electromagnetic stirring" referred to in the FUJISAKI patent (e.g., column 4, lines 10 to 23) means, as in the FUJISAKI paper, generating molten steel flow by imparting moving (traveling) magnetic fields to the molten steel.

Some variation is seen in embodiments in each drawing of the FUJISAKI patent, however, from the objects of the invention (which are, uniformalization of the molten steel circulation flow, the reduction of electromagnetic stirring coil parts and the adjustment of the flow speed distribution of the molten steel without difficulty) disclosed in the above-mentioned portion (column 4, lines 10 to 23) and the description of related art of conventional fields set out in column 1, lines 30 to 37, it is noticeable that with the FUJISAKI patent also, the generation of flow of molten steel, which consequently is the application of moving (traveling) magnetic field, is apparently a precondition.

The above-mentioned alignment comprising u, -v, w, -u, v, -w is identical with the alignment by conventional art depicted in Fig. 4 of the present application (the sign of minus or plus is abbreviated therein, though). It is self-explanatory

from the definition set out on page 4, lines 4 to 10; page 16, line 17 to page 17, line 9; and further from Fig. 4, of the present application that "moving magnetic field", referred to (e.g., page 1, lines 9 to 19, and page 12, lines 8 to 22) in the present application, is identical to the "traveling flux" set forth in the FUJISAKI paper.

In contrast, the present application provides, as its features, a non-moving, vibrating magnetic field (e.g., an AC magnetic field) which involves no traveling of magnetic poles (cf. page 4, lines 4 to 10 of the present application). For example, when the variation of magnetic poles in the alignment of electromagnets shown in Fig. 2 of the present application is tabulated by copying the manner practiced in the above-mentioned table makes the following table, wherein the differences in y phase, in which x = phase degree of 0°, is 180°.

Table A2

Phase (degree) ↓	0	180	0	180	0	180	0	180
0	–	–	–	–	–	–	–	–
30	N	S	N	S	N	S	N	S
60	NN	SS	NN	SS	NN	SS	NN	SS
90	NN+	SS+	NN+	SS+	NN+	SS+	NN+	SS+
120	NN	SS	NN	SS	NN	SS	NN	SS
150	N	S	N	S	N	S	N	S
180	–	–	–	–	–	–	–	–
210	S	N	S	N	S	N	S	N
240	SS	NN	SS	NN	SS	NN	SS	NN
270	SS+	NN+	SS+	NN+	SS+	NN+	SS+	NN+
300	SS	NN	SS	NN	SS	NN	SS	NN
330	S	N	S	N	S	N	S	N
360	–	–	–	–	–	–	–	–

NN+, SS+:Max, NN, SS:about 90% of Max, N, S:50% of Max

That is to say, the N-pole and the S-pole counterchange periodically but have no specific moving directions and rather, vibrate between neighboring electromagnets. As such, a macro flow is not generated in the molten steel but moves with vibration in micro-motion in an acting area within a restricted scope. Thus, the invention of the present application is able to provide a slab of high quality, which has never been achieved, with innovative movement of molten steel, that is, electromagnetic stirring, involving no moving (traveling or shifting) magnetic field (cf. page 2, lines 21 to 25 and page 13, lines 18 to 22).

1-2. Relations between Single/Multi Phase and Moving/Non-Moving Fields

The Official Action urged that the purpose of the present application would become obvious by restricting the present application to a single-phase AC current, however, as set out on page 17, lines 6 to 9, because even with the use of a multi-phase AC current, it is also possible to produce an AC magnetic field, the indication is improper. The invention is not so limited.

For example, by applying proper alignment with a two-phase AC current, not only the moving magnetic field of conventional arts but also the non-moving, vibrating magnetic field of the present invention can be achieved.

For instance, when the alignment of electromagnets with

phase differences comprising, "270° (-second phase), 180° (-first phase), 90° (second phase) and 0° (first phase)" is applied, the magnetic field becomes a moving magnetic field wherein the magnetic poles move to the right-hand side, as shown in the following Table A3.

Table A3

Phase (degree) ↓	270	180	90	0	270	180	90	0
0	SS+	–	NN+	–	SS+	–	NN+	–
30	SS	S	NN	N	SS	S	NN	N
60	S	SS	N	NN	S	SS	N	NN
90	–	SS+	–	NN+	–	SS+	–	NN+
120	N	SS	S	NN	N	SS	S	NN
150	NN	S	SS	N	NN	S	SS	N
180	NN+	–	SS+	–	NN+	–	SS+	–
210	NN	N	SS	S	NN	N	SS	S
240	N	NN	S	SS	N	NN	S	SS
270	–	NN+	–	SS+	–	NN+	–	SS+
300	S	NN	N	SS	S	NN	N	SS
330	SS	N	NN	S	SS	N	NN	S
360	SS+	–	NN+	–	SS+	–	NN+	–

NN+, SS+: Max, NN, SS: about 90% of Max, N, S: 50% of Max

On the other hand, the alignment with "180°, 90°, 0° and 90°" results in a state as shown in the following Table A4 in that, the magnetic field becomes a vibrating magnetic field (non-moving) wherein the magnetic poles vibrate a little more larger than a case with single-phase magnetic poles. The alignment such as that mentioned above is conceivable by a person of ordinary skill in the art without any assistance of other suggestion if only the person has a <u>motive of generating a non-moving, vibrating magnetic field</u>. Such is obtained only by an understanding of the present invention.

Table A4

Phase (degree) ↓	180	90	0	90	180	90	0	90	180
0	–	NN+	–	NN+	–	NN+	–	NN+	–
30	S	NN	N	NN	S	NN	N	NN	S
60	SS	N	NN	N	SS	N	NN	N	SS
90	SS+	–	NN+	–	SS+	–	NN+	–	SS+
120	SS	S	NN	S	SS	S	NN	S	SS
150	S	SS	N	SS	S	SS	N	SS	S
180	–	SS+	–	SS+	–	SS+	–	SS+	–
210	N	SS	S	SS	N	SS	S	SS	N
240	NN	S	SS	S	NN	S	SS	S	NN
270	NN+	–	SS+	–	NN+	–	SS+	–	NN+
300	NN	N	SS	N	NN	N	SS	N	NN
330	N	NN	S	NN	N	NN	S	NN	N
360	–	NN+	–	NN+	–	NN+	–	NN+	–

NN+, SS+:Max, NN, SS:about 90% of Max, N, S:50% of Max

1-3. Conclusion

From the foregoing matters, the definition of a non-moving, vibrating magnetic field becomes apparent and the differences from the moving magnetic field which is a conventional art is conspicuous. Further clearly, there is no inconsistency between "non-moving" and "vibrating". Further, as the applied references does not teach or suggest all the recited features, the claims are non-obvious.

2. Argument For Nonobviousness

The Official Action states that the present invention is obviously conceivable from the thought of replacing a three-phase AC current with a single-phase AC current on the basis of the description of the stirring method by electromagnets disclosed in the FUJISAKI patent.

Nevertheless, as is clear from the foregoing explanation, with conventional arts, the flow of molten steel motivated by a moving magnetic field is the object and hence, the prerequisite condition that a magnetic field ought to be a moving magnetic field is unable to be changed. In other words, because a moving magnetic field is unable to be secured when a three-phase AC current is replaced with a single-phase AC current, hitting per se of the thought of said replacement is not well founded.

The Official Action remarked that a single phase would be more effective than three phase however, this is considered to

be based on general knowledge of the phase factor.

Still, said remarks are not a valid argument in a case of effecting a magnetic field in a material body by arraying a large number of electromagnets. Extremely strong N-poles and S-poles adjacent to each other are recognized in Table A2 inserted above. It is axiomatic for the skilled practitioner that in the forgoing state, short cut magnetic fluxes which do not go through molten bath increase, thereby the number of magnetic fluxes operating on molten steel is small.

Phase (degree) ↓	0		180		0		180
......							
90	NN+	→	SS+	←	NN+	→	SS+

magnetic flux (running through molten metal)

magnetic flux (short cut)

On the other hand, in Table A1 of a three-phase, the phase contrasts of neighboring magnetic poles is small and thus, magnetic fluxes are pushed away to the molten steel side. Consequently, by the skilled practitioner from the viewpoint of merely the efficiency of electric power, a single-phase AC current is conspicuously disadvantageous than a three-phase AC current and therefore, the motive of generating a single-phase cannot be brought into being. Further, the present inventors confirmed through an actual experiment that the efficiency of electricity of a single-phase C current decreases more.

Phase (degree) ↓	U		-v		w		-u		V		-w		U		-v
......															
30	N		NN+		N	→	S		SS+		S	←	N		NN+

2.2 Claim 17

By claim 17 only, a static magnetic field is superimposed on a moving magnetic field which is disclosed in conventional arts.

According to the Official Action, the operation of the superimposition of an AC magnetic field and a static magnetic field is taught by the FUJISAKI patent, however, in Fig. 60A, there is shown merely an apparatus wherein a part of AC magnetic field generating device is replaced by a static magnetic field generating device. In a magnetic field charging apparatus in general (in particular, a moving-magnetic-poles generating device, as seen in conventional devices), wherein electromagnets are aligned in a comb-like shape, opposite magnetic poles are found at relatively adjacent locations and consequently, the extent of interaction with magnetic poles positioned at opposite locations across a mold and interaction with magnetic poles located beyond the most adjacent opposite poles in the aligned direction is at a level which is negligible. The FUJISAKI patent per se indicates that, as shown in Figs. 59, 60A, 61A-C, and 63-

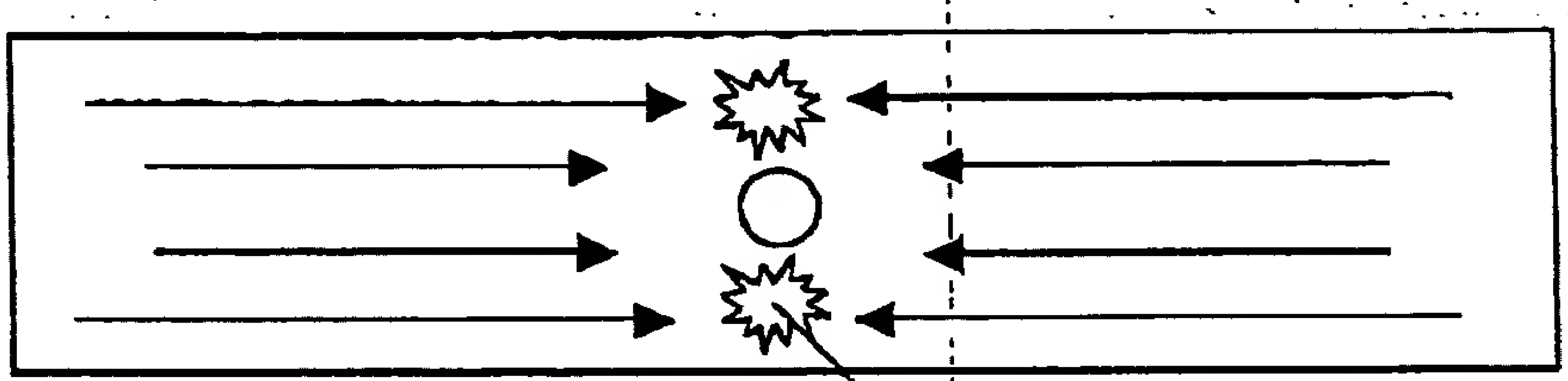
65, bath level is divided into, for example, 4 blocks ("first space" to "fourth space") depending on each block of the row of electromagnets and the magnetic field is charged independently at each block (i.e., not influenced by the magnetic fields of other blocks).

Consequently, the structure of the magnetic poles of the FUJISAKI patent is for merely an operation wherein a static magnetic field (for braking operation) and moving magnetic field (for encouraging movement) are individually formed at each of the blocks of molten bath and this does not teach any of the invention of the present application as recited by claim 17.

Meanwhile, the art disclosed in Japanese Unexamined Patent Application Publication No. Hei 10-305353 is more closely related to the superimposed charging of the invention of the present application, but, the movement of the molten steel by stirring is effected horizontally (cf. paragraph [0012]), which is disparate from the direction of the claims of the present application. Even if a static magnetic field is charged to a rotating-movement-inducing moving magnetic field, interference by the discharging flow from a central nozzle occurs at around two corner portions (cf. Fig. 14, present application).

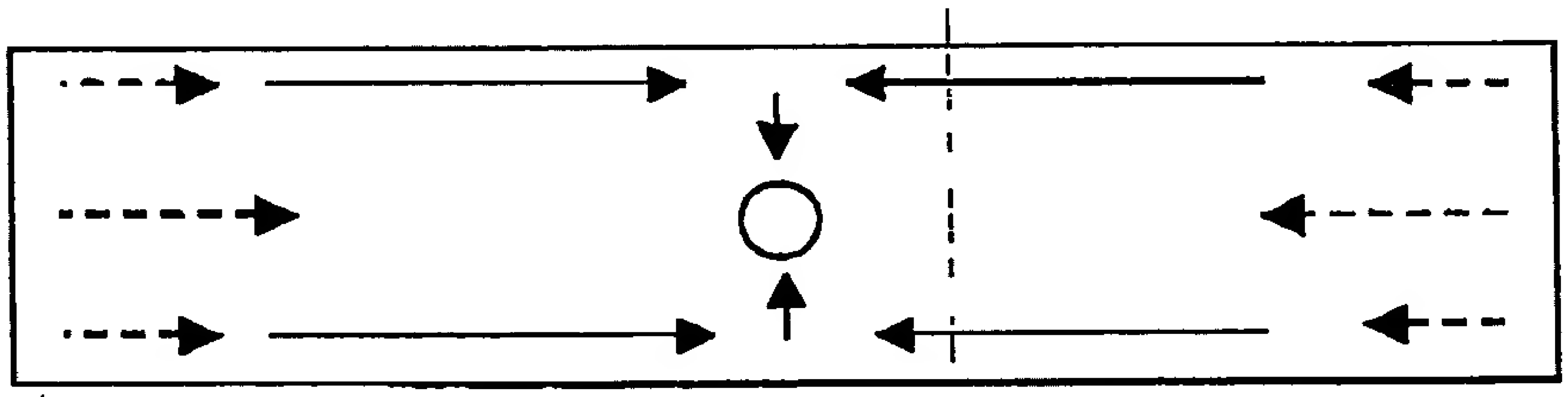
On the other hand, there is an example of not charging a static magnetic field, wherein the moving direction, which is similar to that of the present application, is designated, but, solely with a moving magnetic field, a convection current toward

the center portion in the mold thickness direction is generated and thus, interference at the central portion is caused (cf. drawing below).



(Arrow of solid line: Flow of molten bath caused by moving magnetic field)

Only in a case where the flow of molten steel is limited to portions around a mold surface by superimposingly charging static magnetic fields, molten steel flow free of crosscurrent is able to be secured (cf. following below).



(Arrow of solid line: Molten bath flow by moving magnetic fields; arrow of broken line: (reflection of) molten bath flow of molten steel discharged from a nozzle)

Accordingly, the features of the present invention recited by claim 17 are also not taught or suggested by the applied reference.

In view of the above, reconsideration and allowance of all the pending claims are respectfully requested.

Attached hereto is a marked-up version of the changes made to the claims. The attached page is captioned "VERSION WITH MARKINGS TO SHOW CHANGES MADE."

In view of the foregoing, therefore, it is believed that this application is in condition for allowance, and an early indication of the same is respectfully requested.

Respectfully submitted,

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Enclosures

VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

Claim 1 has been amended as follows:

--1. (twice amended) A method of continuously casting metals, comprising applying a non-moving, vibrating magnetic field having a frequency no greater than 65 Hz to a molten metal in a casting mold to impose only vibration on the molten metal, wherein non-moving magnetic field is defined in that a wave representing an intensity distribution in a direction of a longitudinal width of the casting mold thereof does not move in a certain direction.--

18/19

Reference Table

amended ⇓ amended ⇓

				This invention					
Objective movement of molten metal				Stirring without macroscopic circulation flow					
				Claims 1 to 6: Vibration			Claims 9 and 10: Vibration (enhanced)		Claim 17: Laminar macroscopic flow only near "surface" (flow is weak near "center")
Magnetic Field				Non-moving / Vibrating			Non-moving / Vibrating (Static field superimposed)		Moving (toward 'center') / Vibrating (static field superimposed)
Specific examples of embodiment	Example			F	G	H	I	J	K
	AC magnetic field	Type of AC		Single phase		Two phase	Single phase	Two phase	Three phase
		Arrangement of electromagnetic poles (degree)	Raw 1	0 /180/ 0 /180	0 / 0 / 0 / 0	0 / 90/180/~~270~~ 90	0 /180/ 0 /180	0 / 90/180/~~270~~ 90	0 / 60/120/(Center)/120/ 60/ 0
			Move	↔ ↔ ↔ ↔ / ↔ ↔ ↔ ↔	↕ ↕ ↕ ↕ / ↕ ↕ ↕ ↕	↔ ↔ / ↔ ↔	↔ ↔ ↔ ↔ / ↔ ↔ ↔ ↔	↔ ↔ / ↔ ↔	→ ← / → ← / → ←
			Raw 2	180/ 0 /180/ 0	180/180/180/180	180/~~270~~ 90/ 0 / 90	180/ 0 /180/ 0	180/~~270~~ 90/ 0 / 90	0 / 60/120/(Center)/120/ 60/ 0
	DC magnetic field			Non			Applied superimposedly		Applied superimposedly.
	Note						By superimposed DC field, vibration (or flow) near "surface" is enhanced, while any flow near "center" is weakened		
	Disclosure			Fig. 2, etc. / pages 10 to 13	Fig. 3, etc. / pages 10 to 13	Not disclosed	Figs. 9, 11, etc. / pages15 to 20	Not disclosed	Figs. 13, 17, etc. / pages28 to 32
Effect				Avoid inclusions due to local vortex or stagnation, etc., by stirring without macroscopic circulation flow.					Avoid inclusions due to local vortex or stagnation, etc., by stirring with macroscopic non-circulation flow only at "surface".

'center':center of the slab width direction
"center":center of the slab thickness direction
"surface":surface of the slab thickness direction

Reference Table (Continued)

amended

	Conventional Technology		Fujisaki et. Al.		
Objective movement of molten metal	Macroscopic flow to stir molten metal		Uniform macroscopic flow to stir molten metal		
	Macroscopic circulation flow	Macroscopic non-circulation flow	Macroscopic circulation flow		Macroscopic non-circulation flow
Magnetic Field	Moving / Vibrating		Moving / Vibrating (advanced)	Moving / Vibrating (Partially static)	Moving (toward 'center') / Vibrating
Specific examples of embodiment: Example	A	B	C	D	E
AC magnetic field: Type of AC	Three phase	Two phase	Three phase	Three phase	Three phase
AC magnetic field: Arrangement of electromagnetic poles (degree): Raw 1	0 / 60/120/180/240/300	0 / 90/180/270	0 / 60/120/180/240/300	0 / 60/120/(Center)/ ＜DC＞	0 / 60/120/(Center)/120/ 60/ 0
AC magnetic field: Arrangement of electromagnetic poles (degree): Move	→ ←	← →	→ → ← ←	→ ←	→ ← → ←
AC magnetic field: Arrangement of electromagnetic poles (degree): Raw 2	300/240/180/120/ 60/ 0	~~180/270/ 0 / 90~~ 270/180/90/0	0 / 60/120/180/240/300	＜DC＞ /(Center)/180/240/300	0 / 60/120/(Center)/120/ 60/ 0
DC magnetic field	Non	Non	Non	Applied-separately (different block)	Non
Note			Divided into plural blocks so as to control the strength of the magnetic field separeyively		
Disclosure	Fig. 4, page 12 (This Application) / Fig. 3, columns 1 to 2 (Fujisaki et. al.)	Not Disclosed	Figs. 6, 8, 9, 15, 16, 18, 20, 28, etc. / columns from 8	Fig. 60A, etc. / columns from 29	Figs. 51A to 51C, etc. / columns from 26
Effect	Avoid segregation and capture of inclusions at solidified shell, by stirring (Macroscopic flow which creates local vortex or stagnation makes above effect insufficient, and also causes entrainment of inclusions.)		Avoid segregation and capture of inclusions at solidified shell, by stirring (Same as conventional technology). Trying to achieve macroscopically uniform circulation (or non-circulation) flow. (Because of macroscopic flow, local vortex or stagnation is not sufficiently avoided, and said problems are not fully solved)		

'center': center of the slab width direction
"center": center of the slab thickness direction
"surface": surface of the slab thickness direction